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No. 81

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# WEST EUROPE REPORT SCIENCE AND TECHNOLOGY

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## BIOTECHNOLOGY

### BRIEFS

BELGIUM SUBSIDIZES BIOTECHNOLOGY--The Belgian government has developed a financial support program for research in biotechnology. It will enable Belgian industry to build up capacities rapidly and develop the technologies required for Belgian firms to successfully compete in world markets. The new initiative expands previous activities of the regional Belgian governments in this area. [Text] [Duesseldorf EUROPA CHEMIE in German No 24, 1981 p 407] 9160

CSO: 3102/10

## ELECTRONICS

### NORWEGIAN MINICOMPUTER FIRMS EXPANDING RAPIDLY

Duesseldorf VDI NACHRICHTEN in German 11 Sep 81 p 25

[Article by B.W.: "Increased Production of Minicomputers in Norway--Computer-Based Mapping Systems Succeeding"]

[Text] "We are small, a bit crazy, but good." This is how Per Aarsted, vice-president of the Norwegian Export Council, characterizes the Scandinavian data and communications industry. Indeed, those who have witnessed the high level of development of the Norwegian firms can only conclude that in reality Norway stands for much more than just fish, crude oil, wood and midnight sun. It has succeeded in building up a vital industry with an extremely high degree of automation accompanied by improved production efficiency.

Recently established companies--e.g., Norsk Data AS, Oslo, which is aiming at becoming one of the five largest suppliers of minicomputers in Europe; Stentor AS, Trondheim, manufacturer of in-house communications systems, which by its own account is the leading company in this market; or Tandberg Data AS, Oslo, which came out of the Data Division of Tandberg Radiofabrikk in 1979 and concentrates on the functional design of its display terminals in compliance with operational and ergonomic requirements--are obviously pursuing a clear course of specialization. Their philosophy is to find market gaps and fill them with products that are competitive worldwide.

It is evident that small companies can, in fact, finance the necessary investments. In addition, companies of this size (Tandberg Data, with annual sales of 107 million kroner; Stentor, with annual sales of 74 million kroner; and Norsk Data, with annual sales of 313 million kroner) have proven to be more flexible; for instance with regard to shifting to new products, as has been demonstrated in Norway. Their managements, consisting largely of young, enthusiastic people, have contributed greatly to the success of these expanding businesses. The growth rates of the companies named are between 30 and 45 percent.

Certainly, excessive specialization also holds dangers. In an attempt to partially circumvent this risk, exports are spread to many countries. The reason given is that the entire market thus becomes less susceptible. It is obvious, however, that the FRG is the main target of the majority of the Norwegian data and communications companies. It appears that they do not fear competition from Japan and the United States. The Norsk Data management says that the main competitors in Europe

are the national manufacturers. In this connection it is observed with obvious suspicion how some FRG public agencies award their orders. There have been several negative experiences with fund allocation for university computer centers which wanted to award their orders to Norwegian firms. This was prevented by "influential persons." A study by Karl Georg Schjetne of Trondheim University quotes total annual sales by Norwegian producers of computers to be 1.8 billion kroner, with 4,200 employees. According to this study, exports constitute 60 to 70 percent of this figure, and the growth rate achieved in recent years has been between 20 and 25 percent.

A totally different strategy from that of the companies mentioned is being pursued by a more conservative firm, AS Kongsberg Vapenfabrikk, Kongsberg. Kongsberg is not relying on one specific product area; the data division ranges in mid-position with an 11 percent share in sales. This company stresses cooperation with companies from the FRG. According to the company, cooperation with Messerschmitt-Boelkow-Blohm (MBB) in the field of computer-aided cartographic systems has proven successful. "Norway needs the FRG," Per Aarsted says, "and the FRG needs Norway."

9544

CSO: 3102/6

## ENERGY

### ELECTRON BEAMS IMPROVE EFFICIENCY OF SOLAR CELLS

Frankfurt/Main ATOM + STROM in German Jul/Aug 81 p 124

[Article by of: "Electron Beams Improve Efficiency of Solar Cells"]

[Text] An electron-beam generator for short-term thermal treatment of the surfaces of solar cells has been developed in the Karlsruhe Nuclear Research Center (KfK). This short-term tempering is of major importance for the cells' efficiency in converting sunlight into electrical energy. Furthermore, the new electronic-beam generator promises a highly economical performance of this major step in mass-producing solar cells.

The solar cells now envisaged to be mass-produced mainly consist of monocrystals of silicon, a semiconductor, in which the foreign atoms are accommodated in very low and precisely controlled concentrations. The incident light releases electrons with negative charges and positive charges--"holes"--in the silicon, which are separated by means of the electrical effect of the accommodated foreign atoms and result in a usable electrical voltage. One well-known technical application of this principle is the light meter in cameras.

For physical reasons the maximum efficiency of such semiconductor elements, i.e., the relationship of usable electrical energy and incident light energy, is approximately 20%. Efficiency rates achieved in practice are now at about 10% and are largely dependent upon the quality, i.e., the flawless structure of the crystal lattice of the light-sensitive surface layer. A prerequisite for high quality is thermal treatment--tempering--of the surface, which has the effect of healing the crystal flaws caused by the accommodation of foreign atoms but does not cause a redistribution of the foreign atoms through diffusion. Because of physical properties, the tempering can be short-term only. Similarly, such a procedure is the prerequisite for cheap solar-cell mass production because it permits continuous treatment of large areas with low energy requirements. Short-term electronic beam pulses of a certain energy density, which do not penetrate deeply into the semiconductor layer and which cover a relatively large area, lend themselves to this purpose, but it had so far not been possible to produce them.

For this purpose the KfK's Institute for Applied Nuclear Physics (IAK) developed an electron-beam generator with the characteristics required. The electron beam has a variable energy of 10 to 25 kilo-electron-volts corresponding to the required depth of penetration of up to 1,1000 mm. The pulse duration is about 3/10  $\mu$ s, the

current densities in the beam are 1000 to 3000 A/cm<sup>2</sup>, and the pulse energy stored in the material is variable between 0.3 and 2.5 J/cm<sup>2</sup>. The diameter of the electron beam is approximately 5 cm at the location of radiation. These operating data are unique in the field of electron-beam technology.

The development in the IAK lasted some 2 years and cost approximately DM 80,000. Laboratory testing of the equipment was successfully completed. At present it is being used by interested parties for the test-manufacture of solar cells. Its further development is aimed at industrial applications.

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CSO: 3102/6

## ENERGY

### BRIEFS

COMMERCIALIZATION OF SOLAR TECHNOLOGY--Paris --Creation of "ELF Solar Energy Development." The "ELF" company announced on 9 September the creation of an affiliate devoted 100 percent to the industrial and commercial development of the results which "ELF Aquitaine" has obtained from several years of research in the energy field. This company named "ELF Solar Energy Development" will carry out the group's activities in the sectors of thermal and photovoltaic applications of solar energy and will develop its program on an international scale. [Text] [Paris AFP Sciences in French 10 Sep 81 p 42] 9816

CSO: 3102/434

## INDUSTRIAL TECHNOLOGY

### GOVERNMENT PROMOTES USE OF MICROELECTRONICS THROUGH 'MAP'

Paris ZERO UN HEBDO in French 14 Sep 81 p 24

[Text] It's not often that one can credit a government with having imagination.... However, this time, in Great Britain, there is a discernible effort. Since spring, and until the end of September, British stations one after the other are harboring along their platforms a train with five vivid blue cars bearing the letters MAP, which stand for "Microprocessor Application Project."

What's involved is a government financed plan to make businesses, especially small ones, aware of the advantages they can gain by using microprocessor technology.

The train includes two cars devoted to an exposition of microelectronics, with examples of applications in management and process control, and demonstrations of the possible use of microprocessors in the development of new products and the improvement of existing products.

The other cars are devoted to a micro-information laboratory, a conference room, and a reception room. The train spends a week in each of the 21 cities on its itinerary, and offers each time a complete range of various activities.

#### A Week in Each City

Day-long seminars, "Micros for Managers," are aimed at businesses with fewer than 300 people. The "Computing Services Association" holds meetings on the subject of the training required to carry out successfully projects calling for microelectronics. The systems installed on board can be reserved in advance by potential users, who can test them and later bring their real data. Finally, there are organized visits for school children and teachers, forums on the social implications of microelectronics, and even expositions on microelectronics, and even expositions on microelectronics for the handicapped.

All these things are manifestations of a 55 million pound program (MAP), preliminary studies of which had shown that it was sorely needed in Britain, since some 50 percent of British businesses had no notion of the possible benefits which microelectronics could have for them.

Progress is nevertheless being made. According to the latest figures published by the government, 134,000 people have already participated in the MAP meetings and seminars. Nearly 2,000 feasibility studies have been completed, and 90 to a 100 are being conducted each month. Moreover, the government has financed more than 450 development projects utilizing microelectronics, in all sectors, from agriculture to consumer goods.

#### Government Interventionism

One often hears it said that with Mrs Thatcher the British Government has become totally non-interventionist in economic activities. That does not correspond to reality, if one may judge from MAP.

There are other examples. In particular, financiers, who wish to invest in microelectronics but who are unable to appreciate the technical aspects, can call on government experts who will give them a technical opinion allowing them to make their decision. At the present time, 16 financial organizations have expressed interest.

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CSO: 3102/434

## INDUSTRIAL TECHNOLOGY

### DASSAULT TO MARKET THREE-DIMENSIONAL CAD/CAM SYSTEM

Paris L'USINE NOUVELLE in French 24 Sep 81 pp 103-104

[Text] In deciding to market their know-how in computer-assisted design and manufacturing, the Avions Marcel Dassault-Breguet Aviation Company intends to take advantage of their highly interactive three-dimensional system which is somewhat ahead of the competition.

The decision has been made: Dassault will compete with IBM! This is being revealed by l'Usine Nouvelle. The news will make some noise: the Avions Marcel Dassault-Breguet Aviation Company, which has developed a solid reputation in the field of combat aircraft, has just made a 180 degree turn. They intend to market their know-how in the area of computer-assisted design and manufacturing (CFAO).

Mr Francis Bernard, head of the CFAO design and development department, explained this historic decision to l'Usine Nouvelle: "At the present time, we are 2 to 3 years ahead in this area. In these conditions, we had two possible strategies: we could keep our system and run the risk that sooner or later another one would become the industry standard. Or we could choose the opposite path, that is to market our system so that our work can serve as a reference in the future, and itself become the standard."

As we can see, Dassault approach is aggressive. The system they have developed, named CATI (Computer-Assisted Three-dimensional Design), breaks with the systems currently in use in industry. It does not operate in two-dimensional space, but truly in 3 dimensions. Thus, work which previously required 2 months, using conventional methods, now requires only 4 days using CATI. But the system's advantage does not lie in this characteristic alone. The ease with which the man-machine dialogue is carried out and the fact that non-specialists can use it too add to its attractiveness. This is due to the characteristics of the equipment as well as to the functions of the program. From the hardware standpoint, graphic terminals of the IBM 3250 type have been selected. The screen is updated instantaneously and permanently. The terminal system includes an alphanumeric keyboard-display use to work on data and display information such as coordinates or historical data. The program uses real-time versions of old batch programs developed through Dassault's experience with the "Drapo" system, including in particular the Lockheed Cadam program. This explains the close compatibility of CATI and CADAM.

The structure of the Cati program involves 3 logical areas. First is the monitor which is of interest primarily to the programmer. It is close to the IBM system and is written in assembler language and insures the independence of applications from the hardware. The application support includes all the conversational and system management tools necessary for the handling of elements in 2 or 3 dimensions. It is practically independent from the hardware and from the application programs and performs four major functions: data storage management, screen picture handling, management of the disk resident data base, and assistance for interactive procedures. The program handling the latter function includes several subprograms used in the third functional area: the application. Operator commands are kept to a strict minimum. Using the overall structure, the dialogue has been designed in order to reduce the amount of operator-training and support documentation needed, and the number of interactions in the application.

It is in the area of graphic applications that Cati differs most markedly from the competition and pulls ahead by several lengths. In its present state (the enormous 160,000-instructions program is constantly improved) Cati offers three main functions: definition of shapes, complex mechanisms, and manufacturing. As in the older RA 3D, Euclid, Systrid, or Unigraphics, shape definition is based upon a three-dimensional base concept. This is where the product is basically different from others limited to 2 or sometimes even "2-1/2" dimensions. Looking at the most sophisticated programs, one finds products such as Euclid designed to process three-dimensional shapes using the so-called "polyhedral" method where computation and handling of hidden surfaces are simplified by dividing volumes into small polyhedrons, and others such as Systrid where volumes are generated by complex surfaces. Processing is then performed on an exact digital representation of objects. Cati is an improvement in that it is the only one to use both approaches with the possibility to go from one to the other at any time and to use powerful mathematical tools (algorithms, resolution of intersection equations, etc.)

The second main function involves complex mechanisms and data processing. In this case, a mechanism is considered as a set of solids (previously defined) constrained in some manner (rolling, sliding, etc.) An advantage of Cati over the competition is that it allows the construction of a mechanism and its environment, motion simulation on the graphic screen to determine velocities, accelerations, and stresses. The operator is able to modify the geometry of solids and their linkages in order to optimize mechanisms. The last function is related to manufacturing. It is the tool used to prepare the numerical control machining of the geometrical elements stored in the data bank. There is thus a direct connection between the development laboratory and the machine floor which also exists in competitive products (Systrid, Unigraphics, etc.) It is to be noted that permanent visual control of the machining operation allows the operator to prevent errors and if required, to modify the geometry of a part to better adapt it to manufacturing processes.

In the light of this technical assessment, it is easier to understand why Dassault decided to go into the CFAO business. Cati is a high performance product and is practically complete. Its applications can be across multiple industries wherever shape-handling is required, such as the automobile industry, ship-building, aeronautics, architecture, civil engineering, boiler-making, etc. Cati is the result of at least 5 years of research and development. "The use of interactive data processing systems at Dassault goes back to 1975 that is, real-time graphic

systems. The use of computer design in the company goes back much further. It began in the years 1965-1966. The first aircraft to be designed using computers were the Mercure and the Alpha-jet" says Mr Francis Bernard.

Today seven plants of the Dassault group (Argenteuil, Biarritz, Merignac, Toulouse, Saint-Cloud, and the Generale de Mecanique Aeronautique plants at Seclin and Poitiers) use the Cati system. In all 70 to 75 terminals are used and it is estimated that about 500 persons are trained on Cati.

Dassault is determined to have the system in use outside the company:" by the end of the year, Cati will be available on the market, says Mr Francis Bernard, it is in operation in some test installations."

Naturally, the first Dassault customers want to announce their decision to purchase themselves. We may however reveal that four German companies (two in the aeronautics area and two in the automobile industry) are interested in the system. Mercedes-Benz will soon start using it as a test installation. The first French orders are expected soon.

So the CFAO war, that some do not hesitate to label the "fight of the century" which will decide the real industry leaders in the year 2000, has just started. By deciding to be first to go on the war path, Dassault has probably taken the advantage.

But the competition--mostly American--will certainly not stop there. Lockheed with Cadam, McAuto (a McDonnell Douglas subsidiary) with Unigraphics, Computer-vision, Applicon, Calma, Battelle (with Systrid developed by the Aerospatiale Company), to name only these six companies, will certainly rise to the challenge.

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CSO: 3102/18

## INDUSTRIAL TECHNOLOGY

### BRIEFS

INCREASED AUTOMATION IN FRANCE--Even if CODIS [Committee for the Development of Strategic Industries] is destined to disappear, the Ministry's action in favor of production automation will be increased and even developed next year. The objective remains the same: within 3 years, to double investments in automation (3.5 billion francs in 1980). Thus the MECA procedure [Advanced Design Machines and Equipment] (100 million francs in 1981) intended for small and medium industries will probably be continued with an important budget increase. For large industries intending to develop pilot operations (such as flexible workshops), procedures will be simplified. Finally, part of the effort will be on research and training. [Text] [Paris L'USINE NOUVELLE in French 24 Sep 81 p 71] 6445

CSO: 3102/18

## TRANSPORTATION

### BELGIAN FIRM HOPES TO PARTICIPATE IN ATR 42 PROGRAM

Brussels LE SOIR in French 22 Sep 81 p 7

[Article by Pierre Bary: "The Belgian Firm, SONACA, Wants to Participate in New Civil Aircraft Programs"]

[Text] The specialized American periodical, AVIATION WEEK, announced this week that the Belgian firm, SONACA, is continuing discussions with AEROSPATIALE [National Industrial Aerospace Company] and AERITALIA for participation in the French-Italian ATR 42 aircraft program. Further, according to the American publication, the conversations are centered upon assigning to SONACA fabrication of the tail unit of that airplane, which is capable of transporting from 42 to 46 passengers, depending upon seat separation, over flight legs of about 1,300 kilometers.

Mr Claisse, assistant manager of SONACA, whom we questioned, confirmed that contacts had taken place, and are still going on, with a view toward participation in that program. But up to now nothing has been signed. Nevertheless a dossier is being prepared so that the government may be informed at the proper time. In the event of an agreement SONACA will need financing for its research and development work as well as for acquiring tooling.

#### Choosing the Right Horse

Mr Claisse reminded us that the company is seeking every opportunity to diversify its activity in the civil sector so as to break excessive dependence upon military orders. But, according to him, it is entirely a matter of choosing the right horse. The ATR42 is certainly a good project in the category of third level transport, particularly if one can interest the Americans in it, as there are good reasons for hoping. But SONACA does not intend to join that project solely, all the more so as there is still no certainty that this airplane will be built. Within the range of smaller aircraft (30 to 40 seats) there are two other projects worthy of consideration: the Canadian Dash 8 and the half Swedish, half American Saab Fairchild 340.

SONACA has also begun talks with these manufacturers for the purpose of securing sub-contracts which can contribute to maintaining its work load. The relative firmness of the dollar obviously makes its proposals more competitive.

Even though nothing is settled, SONACA indeed intends to enter the ranks, as Mr Claisse again told us.

#### Market for 5,000 Airplanes

The ATR42, for the construction of which a decision is expected before the end of the year, is going to occupy top rank in the range of what in the United States is called the "commuter" network. These airplanes, providing from 20 to 50 seats, serve to link medium size regional centers located off the mainlines of air traffic.

As we were reminded at the Le Bourget Aeronautical Salon, the aircraft of this category are undoubtedly less glamorous than of jumbo jets. But they no less meet a need of the market. At present there are more than 4,000 airplanes of this category--twin turboprops for the most part--in operation worldwide. And it is estimated that between now and the end of the century more than 5,000 must be produced to replace the oldest airplanes, which often date back more than 20 years, and to meet new market requirements. This has not escaped the notice of manufacturers, who have prepared numerous projects. The best known are those of Short Brothers in Ireland, De Havilland in Canada, Embraer in Brazil, Dornier in West Germany, Saab in Sweden and Fairchild in the United States, the last two having joined forces for joint construction of an airplane, and not to forget Fokker, which has continually perfected its F-27, of which nearly 1,000 units have been produced.

#### New Technologies

Such development would not have been possible without the perfection of new, higher performance engines which are therefore more economical in fuel consumption. It is to this task that the leading American engine manufacturers have buckled down--General Electric, Pratt and Whitney, Lycoming, Allison, and Garrett, not to omit mention of the French engine manufacturer, Turbomeca.

But it is the engines of Pratt and Whitney's Canadian division, whose power can range as high as 2,500 horsepower, with which the ATR42 will be equipped. In the basic version the engines will be of 1,800 rated horsepower, the maximum power not being required for the elongated versions.

When AEROSPATIALE interested itself in aircraft of this type it wanted to benefit from the experience which it had acquired with the Nord 262. It had at that time sketched out the project for an airplane of 40 seats known under its designation A535. In July 1980 it signed an agreement with the Italian manufacturer, Aeritalia, to develop a new regional transport airplane. In the beginning of 1981 the two partners, after contacts with transport companies, defined the ATR42, for start-up of which a decision is expected in the coming months.

The objective sought is to have recourse to the advanced technologies commonly used in "jets" in order to increase safety, reduce pollution, and provide greater comfort.

In the final analysis it is a matter of attaining more profitable operation, thanks to more efficient engines and simplification of the rules of operation.

Even though the French and Italian partners emphasized their intention of going ahead at the Le Bourget Salon, they have never concealed their desire to find a representative upon the American continent, which remains the main "commuter" market. Contacts have been made with several American aeronautical firms, among them Lockheed, which may take up a 20-percent participation in the program. On all sides it is considered that such backing could truly be the send-off for starting the ATR42, in which SONACA would then take part.

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CSO: 3102/2

## TRANSPORTATION

### FRANKFURT AUTO SHOW: LATEST PRODUCTION MODELS, PROTOTYPES

Paris L'ARGUS DE L'AUTOMOBILE in French 24 Sep 81 pp 1, 4-6

[Unsigned article: "Frankfurt, An Auto Show Facing the Future"]

[Text] Colossal! No other qualifier can do justice to the attractions of the 1981 Frankfurt Auto Show, given the many new and varied discoveries that it offers. This odd-year show--with Paris having the honors of the even ones--has enjoyed a large number of world premieres: Renault 9, Opel Ascona, VW Polo, Santana, and Derby, Mercedes 380 and 500 SEC, Volvo 245 Turbo, Porsche 944, Fiat Argenta and Ritmo Abarth, Nissan Stanza, Daihatsu Charmant, and Toyota Celica XX!

Already turned toward the automobile's industrial and commercial future, the show was crammed with experimental prototypes. It was not only the fulfillment of a research program launched in 1978 by the Federal Ministry for Research and Technology that made it possible for us to admire the likes of Eve and Vera, VW's Auto 2000, the UNicar of Karman associated with several German universities, a Mercedes experimental car, and Audi's prototype, unfortunately absent from the show; but most builders did not wait for official subsidies to display their own projects: Ford, with a remarkable Probe III (Cx 0.22); and Opel with a superb Tech 1 (Cx 0.24) on a Kadett base, so beautiful that we would want to see it on the street right away. Porsche went all out with a 960, an all-aluminum 928, and at the last minute, a 911 convertible coupe--turbo--with four driving wheels! Even the Japanese got involved: by means of a few sheets of aluminum for the body, and with the aid of a wind tunnel, Honda put together a Civic which is satisfied with only two liters of gasoline per 100 km.

Everyone presented devices for low fuel consumption, all the cars were crammed with electronics and microprocessors, while instrument panels became digitalized, complicated, and complemented with artificial voices (VW, Toyota) to warn the driver.

Beyond the hopes riding on good old piston engines, Frankfurt marked the return of gas turbines, and the prototypes being exhibited did not come out of tinkerers' shops: what could be more serious than Daimler-Benz, Garrett, and Volvo?

And finally, proving (as if that was still was necessary) that the automobile will never be relegated to the rank of utilitarian wheels, we had the convertible coupes. Honors to Fiat, whose Ritmo Cabrio will be mass produced, but



From the Opel Tech I ...



... To the Ford Probe III



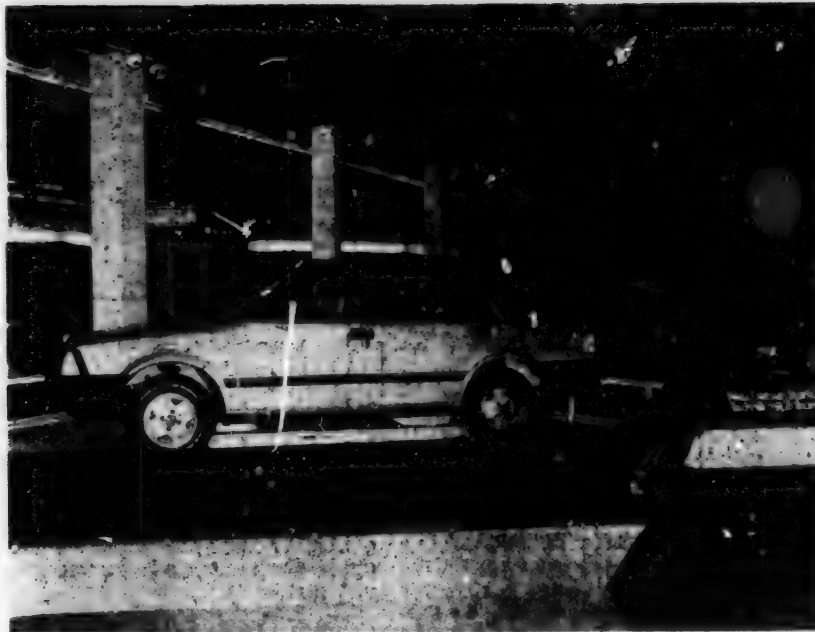
Engineers from throughout the world rushed to examine the Renault 9 in detail.

congratulations as well to Opel, whose styling department has very quick reflexes, and to Ford, whose Escort convertible prototype is simply superb. This revival, which so far has benefited only the VW Golf, was confirmed by the body designers; some of them have skilfully cut away Hondas and Toyotas to turn them into delightful convertible coupes. Show of the future as well as of imagination and technology, Frankfurt will be a significant milepost in the history of the automobile.

In Germany as in France, the automobile market is in the doldrums, and in Germany as in France, manufacturers are forging ahead, strengthening their technologic potential, constantly improving their products, studying, and creating new materials which will assure the commercial future of their enterprises. The first two photographs, which represent the very latest studies in aerodynamics and advanced designs, are examples of these efforts.

As Eberhard V. Kuenheim, chairman of the board of BMW AG, said at the press conference held for the Frankfurt show: "The German automotive industry has maintained its key position. That it has succeeded to do it in such difficult times, bolsters our confidence that it will be able to also do it in the future." But he also hints at some concern when he states: "The most important thing is to allow the mechanisms of the marketplace to do their work, and therefore to keep the interventions and prescriptions of the state compatible and at a minimum." This is an allusion to the demands of several ministries to obtain a reduction in fuel consumption as well as a new reduction in exhaust gas pollution.

The same reserve is expressed at Volkswagen, where Dr W. P. Schmidt, member of the board of directors, observes that car orders will have reached their lowest point during the summer of 1980, followed by a definite stabilization. And he adds: "We do not expect to see a significant reduction in sales in the months to come ... but unfortunately a number of factors are also slowing down a pickup in sales. Notable



The Nissan Stanza was introduced simultaneously in two and three-compartment models.

in this respect is the purchasing power of households, which has been reduced by higher energy costs, as well as by the higher taxes and economy measures instituted by the federal government. Added to these are the charges created by the maintenance of high interest rates, and for company cars, the elimination of TVA (added-value tax) deductions, all of which are not without repercussions on sales. These factors have so far delayed the pickup of the demand for cars, which we could have expected under a normal market cycle."

As we can see, the lot of the Germans is no better than that of the French! And the figures confirm this precarious situation: during the first half of 1981, the production of German cars was 7.7 percent lower than that of the same period in 1980 (1,822,609 units compared to 1,974,728); exports were 9 percent lower (942,625 units compared to 1,035,277); and registrations were reduced by 5.1 percent (1,330,060 units compared to 1,400,968). This situation is practically the same as the one we are experiencing in France, the foreign penetration is 27.8 percent, or 2 percent more than in France.

While French vehicles are still esteemed in Germany, this year they are for the first time overtaken by the Japanese, who are capturing 10.2 percent of the market against 9 percent during last year, whereas the French moved from 9.8 percent in 1980, to 8.8 percent this year.

Renault and Peugeot S. A. are still the leaders on the German market. With 58,386 units registered during the first six months of 1981, Renault practically matches the Peugeot group (58,765 units, of which 25,431 Citroens, 16,947 Talbots, and 16,387 Peugeots).



Reappearance of utilitarian design in small cars: the VW Polo.

On the Japanese side, Toyota remains the first, but has reached a stable ceiling at 30,000 cars. On the other hand, Mitsubishi moved from fourth to second place with 27,944 registrations (+47 percent), overcoming Nissan-Datsun, which has lost 1500 units at 22,825 registrations, and Mazda, which is ahead by 1000 at 24,792 units. Moreover, Daihatsu is entering the market with 4846 registered cars compared to 1869 during last year, and Suzuki leaves its mark by increasing its share of the market from 1693 to 4026 cars. Competition is thus very strong even among the Japanese brands.

The fact remains that as a whole, foreign penetration did not spread in Germany and is stabilizing around 370,000 units at 27 percent for each of these two six-month periods. This is a testimony to the strong resistance of the German manufacturers, who are limiting their losses to 6.5 percent on a market where competition is quite open, and where the Japanese are not faced with the "3 percent law" as in France. The many new items presented by our Rhineland neighbors at this 49th Salon de l'Automobile in Frankfurt, should allow them to even better control their own market, and to provide better trump cards for their industry, which is resolutely facing the future.

A visit to the exhibits can only convince us.

Goodbye R 5 Alpine Turbo

The funniest moment during the opening of the Salon occurred Tuesday at noon, when the Renault brass, arriving from Paris, found a Renault 5 Alpine Turbo on the stand. As the reporters asked for details, the Renault management first believed this to be a monumental joke before changing their tune: the car was indeed there even though the release for the official presentation was scheduled for 25 September. The car disappeared within five minutes! On the other hand, the thousands of copies of the RENAULT JOURNAL, the sales brochure presenting the company's line, could not be made



On the left, the Opel Ascona; on the right, the Ford Escort. Convertibles have been very favorably received.

to disappear as well. And while the official information will be disclosed at the end of the month, the German public already knows everything about this R 5 Alpine Turbo, the direct competitor in all respects, of the Golf GTI. At a top speed of 185 km/h it is even faster than its German rival, it accelerates nearly as well, is undoubtedly more sober, and from all evidence will stop better: the question is whether it will hold the road equally as well. While waiting for this 110 hp bomb, the public was able to console itself with the Renault 9, continuously displayed and filmed by a skillfull and sometimes amusing robot. A good show for those who are fond of technology: the number of engines, transmissions, cars, and various other systems cut-away to show their innards, must be greater than that at all the other Salons combined! Also notable were some remarkable technical films, with the prize certainly being deserved by Ford, who really knows how to make accessible to everyone such difficult topics as aerodynamics or the finite elements method used for computerized body design.

Very Discreet P.S.A.

Presented before the Salon, Citroen's Xenia prototype was not well displayed at its stand. What's more, it was somewhat overshadowed by the competition of German experimental cars almost as advanced in style, but much more sophisticated in technology. A glimpse--was it deliberate?--of a certain Allemagne, a 2 hp in camouflage, with spare jerrycans, reminded us of the all-terrain calling of the dean of the Salon. Equally as funny was the Pony, a Mehari F.A.F., presented outside by the German Citroen license-holder: painted red, and already carrying its virgin license plates, it claimed to be ready for the Paris-Peking Rally, whose occurrence is still not certain! At Peugeot-Talbot (the Talbot name was not even mentioned on the official Salon plan, the two stands being assigned to Peugeot) both stands were combined, with hostesses in blue dresses wearing belts whose color alone indicated their Peugeot or Talbot affiliation. Nothing very new, except perhaps an exercise



Jealous of the Quattro, the Porsche engineers designed this special 911.

in style named *Presidence*, on a *Tagora* base. The name of the game is to install a radio, telephone, dictaphone, hi-fi set, and color TV set with teletext capabilities, in a top of the line SX equipped with power steering and refrigeration air conditioning: the *Tagora* becomes a director's office, but it is not known whether this version, so solemn that it is sad, will be on sale.

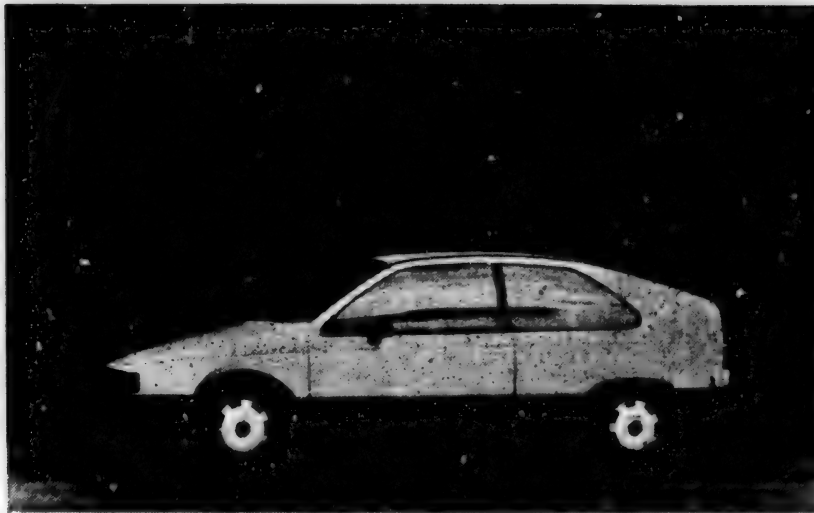
A last point which shocked a number of visitors was that no official sales literature was distributed at Peugeot-Talbot; the names and addresses of visitors were taken for mailings. This may be efficient, but it is unsettling and not likely to create an exhibit atmosphere.

#### VW-Audi in Force

A gigantic stand, which VW-Audi really needed in order to exhibit the entire line of current and future models. The newcomers, Polo, Derby, and Santana obviously were given the choice spots. The latter, while retaining the company's style, seems much more modern than the Audi 80, whose lines it reflects: a fine exercise in design! Noted on the stand: a Beetle, still being produced in some overseas countries, a stubborn symbol of the birth--before the war--of the "people's car" and of its extraordinary proliferation during the 50's. Standard bearer of the German economic miracle, the Beetle will soon be museum fodder: the West Germany of the 80's, with its unemployed and the difficulties of its major industries, already seems to regret those good old days.

#### Celebration at Opel

All the automobile builders have suddenly discovered that their products did not fit in with the energy and economy environment of our times. For purely weight considerations (let us not forget that vehicles are sold by the pound), the research departments have selected front-wheel drives. Opel made the choice in time for the remarkable Kadett, but the normal delay of new model design has deferred, for the

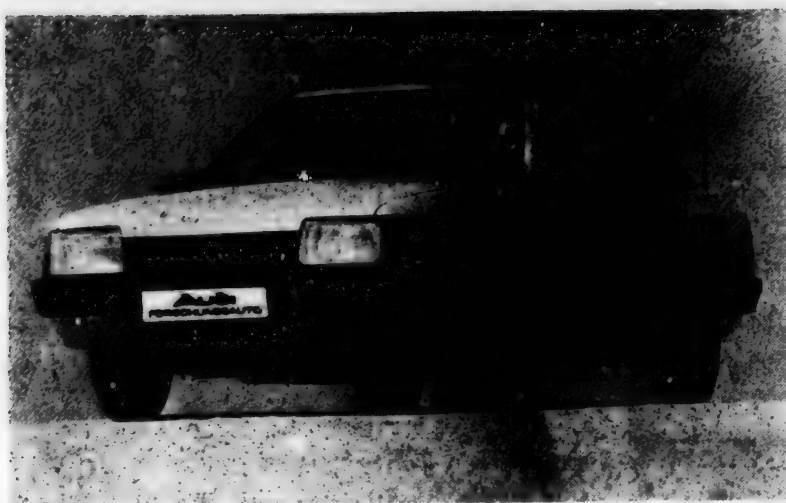


Highly streamlined, this Auto 2000 burns 3.3 liters of diesel fuel per 100 km.

users' taste and wishes, the arrival of the middle of the line Opel. The front-wheel drive Ascona finally made its appearance at Frankfurt, preceded by the flattering reputation of the engines which will power it. Mathematically, the smallest one, once named Junior and competing against Mini Metro and Polo, should also be available soon. As has been their good habit, the engineers of Russelheim have created a superb machine in which the engine and other mechanical elements give birth to a passel of models and versions. The Ascona, the future compact, and the millions of dollars invested in new plants, make it possible to forecast an Opel renaissance, for which the sales networks are rejoicing. From the number of visitors at the stand, the game seems to be well on its way for the German GM affiliate.

#### Creativity in the Major Leagues

BMW, Mercedes, and Porsche (in alphabetical order so as not to offend anyone) remain the major leaguers in technology: BMW starred the remarkable new Series 5, but found it difficult to present their electronics, their strong card, on the stand (which was ever so correct). By contrast, Mercedes used a wealth of turning mock-ups and transplanted test benches to visually convey the technologic image of the company with the three-pointed star. Porsche as well, poured on the technology with a Porsche 960 prototype, an all-aluminum 928, and masterpieces (in the true sense of the word) created by the company's apprentices, who cut up models to show their innards. The cream of the crop arrived late by air: a 911 convertible coupe with turbocompressor and four driving wheels. This remarkable prototype which Porsche will soon evaluate for an eventual sports application, encompasses the two big trends of the Salon: the return of convertible coupes and the teeming of experimental vehicles.



This Audi experimental model also reveals new manufacturing techniques.

#### The Return of the Convertible Coupe

Thanks to Karman with the Golf, and to Triumph with the TR 7, we have rediscovered the pleasure of the convertible, fully convertible, without roll-bars, and with all the structural problems of rigidity inherent in a topless car. With the technology of convertible tops having progressed as far as that of air conditioning and heating, the ownership of a convertible is no longer synonymous with freezing in one's car in the wintertime. Consequently, a public eager to make the most of a car does not hesitate to buy what not so long ago appeared a folly. Fiat, having discontinued its 124 convertible coupe, has just joined the ranks with Ritmo Cabrio, for which the Turin designers had already drawn many convertible versions. At Ford, the Escort convertible version presented was only an exercise in style, but of superior effectiveness, with a metallized grey paint job and a squared back reminiscent of the one on the best-seller in that category, the Golf Karman. At Opel, the pretext is even cleverer: it is the first prize of a competition organized by one of our West German colleagues. The fact remains that a new trend is forming among the public, confirmed by the affluence noted at the stand of the Tropic company, who will cut up any nice Honda or Toyota and make it into an open air car.

#### Research

It was not only by chance that experimental cars were so abundant. In 1978, BMPT (Ministry for Research and Technology) launched a program for the car of the future.

Four projects were started under the responsibility of VW for a medium size compact, Audi for a medium size large car, Mercedes for a large car, and a group of German universities and research institutes for a more flexible goal.



On the left, the Mercedes experimental model accepts three engines. On the right, the Unicar built by Karman.

The two models of greatest interest to the driving public were extremely well conceived and built by VW-Audi (we will discuss them at greater length in a future issue). Mercedes presented a superb vehicle, although its very streamlined style, with a Cx of 0.30, was not unanimously well received. With a plastic body, an electronically programmed automatic transmission, ABS braking, a self-levelling hydropneumatic suspension, microprocessors almost everywhere, this large car weighing 1600 kg net, did not lack attraction. Even more interesting were its three engines: a turbo-diesel V6, a gasoline V8 in a light alloy, with cylinders that can be disconnected, and a gas turbine; they all had a power of 110 kW, or about 150 hp. With the turbine, normalized consumptions are 5.5, 6.7, and 14.2 liters of diesel fuel at 90 km/h, 120 km/h, and in town, respectively; those of the diesel V6, are 5.7, 7.5, and 9.8 liters, to be compared with 7.1, 8.8, and 12.1 liters for the gasoline V8. In all cases, the top speed is 200 km/h, and 0-100 km/h is reached between 11.5 and 13 seconds. A good accomplishment!

#### The University to the Rescue

UNicar is the fruit of the collaboration of four institutes or schools with unpronounceable names, which are more easily identifiable by their initials: they yield the equation  $IKA + IFT + FZD + FKFS = UNicar$ . Starting from ground zero, and blending economy and safety prerequisites, they have designed a new four-seater, weighing 1375 kg, equipped with a 2.5 liter four-cylinder engine. Their offspring looks like a Citroen CX station wagon, has a Cx of 0.25 (0.226 on the mock-up), and averages only 6.55 liters per 100 km. We will return to this interesting project, whose greatest merit is that it exists at all, given that the collaboration of the partners was not obvious at first.

#### At Ford: Probe III

Presented in Geneva and Turin last year, Probe II seduced us, because this project for an economical car was realistic. Frankfurt brings us Probe III, very well developed even though it is ugly. The basic idea was to achieve the equivalent of Taunus, but with half the Cx, or 0.22: the Merkenich (FGR) and Dunton (England) engineers have succeeded. What are the strong points of their research? In front,



The Uniroyal 280 completely reopens the question of the design and aerodynamic function of tires.

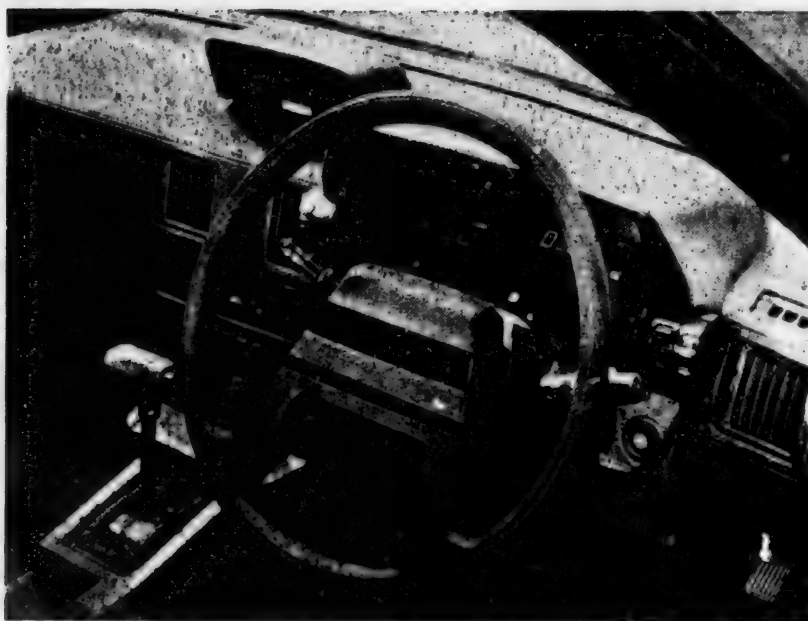
a movable spoiler is raised and lowered according to the engine's cooling air requirements, and is automatically raised during parking. In the rear, a double flap: its upper section operates normally, increasing the efficiency of the lower plane which prevents the updraft of air streams flowing under the Probe III. The lower fairing contributes to good performance: starting with a perfect single shape, the engineers have successfully divided it for accessibility to components, without losing any Cx. And finally, flexible plastic skirts cover the gaps between the tires and the body. For greater safety, the wheels have been covered with large flat hubcaps, and equipped with absolutely revolutionary Uniroyal prototype tires. Not only have their designers solved all the usual roadholding problems, but they have also studied the aerodynamic properties of tires. Whereas a conventional tire sucks air under the wheel to spit it out elsewhere, the Uniroyal does the opposite. Consequently, an aerodynamic vortex which disturbs the air flow near the body is no longer created: this is a first, both in aerodynamics and in tire design.

A Probe III will thus be able to transport four passengers at 170 km/h with the 68 hp engine of the Taunus, whereas the latter must be satisfied with 147 km/h. At equal speeds, the consumption will be infinitely lower. QED.

#### Opel, Porsche, and the Others

At Opel, the equivalent of the Probe III is named Tech 1. Just like its cousin, it is crammed with electronics and equipped with a digital instrument panel. Slightly less streamlined, a Cx of "only" 0.24, it has in exchange the fundamental quality of being pretty. It has nevertheless a variable geometry cooling air intake, but the choice of colors and the windows flush with the body go a long way to beautify it.

Whereas the Probe III is rather ponderous, the Tech 1 is sexy, much like a production model Kadett, and could easily be sold without disturbing the public. Compliance with various aerodynamic rules will undoubtedly cause future cars to resemble each other, especially since their bodies, derived from the same specifications and identically programmed computers, will also look alike. Nevertheless, Opel's styling department has shown that other solutions are possible, and that the function of design departments will be more important than ever.



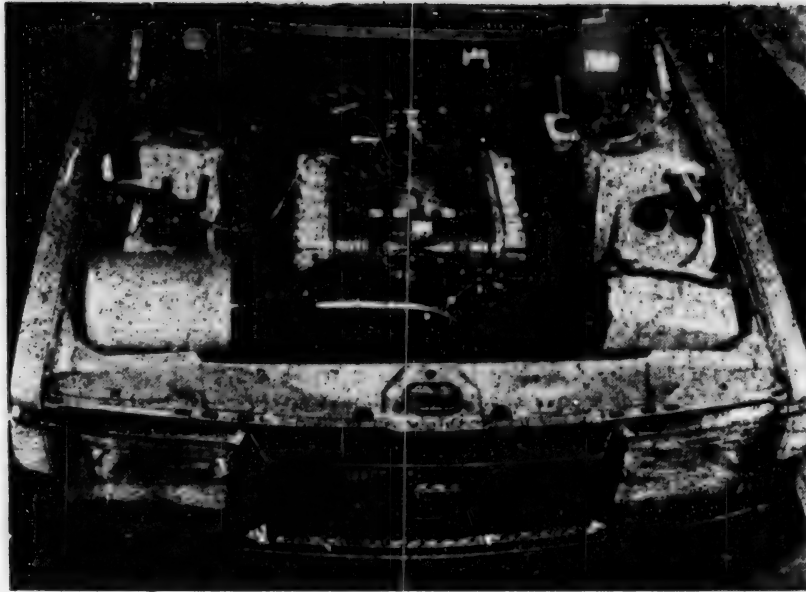
The triumph of microprocessors and electronics: the Toyota Navicom.

Porsche is also working intelligently on lightening, reliability, and engine optimization. They are placing great faith (like everybody else) in aluminum and fiber-reinforced plastics, and are producing results which will be discussed more extensively in a subsequent issue.

On the other hand, the discovery on a stand of a modified Honda Civic with a  $C_x$  of 0.28, calls for some comments. The purpose of the operation was to enter a fuel consumption contest for modified production models: called to the rescue, the parent company created this car, which is as efficient as it is ugly. This proves that the Japanese engineers have full scale wind tunnels and a sound knowledge of automotive aerodynamics: in the end, this very special Civic, running the Hockenheim circuit at 50 km/h on two cylinders, burned 2.077 liters of gasoline per 100 km, and was outclassed only by a Golf diesel, a very special one to be sure, with 2.031 liters of diesel fuel per 100 km.

#### A Little Bit of Everything

A world novelty, the Datsun-Nissan Stanza is interesting in more than one respect. A sort of large Mazda 323, it aspires to the status of world car, and has been introduced simultaneously in two and three-compartment versions. It will not reach France immediately, but the fall of the last bastion of rear-wheel drive is a milestone. When asked, the Nissan management defined its new philosophy, which boils down to: "Front-wheel drive up to two liters, and conventional propulsion for anything over that and for sports cars."



A highly developed gas turbine in terms of weight and size.

For the time being, this also appears to be the philosophy of Fiat, since the Ritmo Abarth (one more anti-Golf!) is equipped with the well-known dual-camshaft two-liter engine. At Ford, the XR3 Escort has been helped by a 1600 i Porsche with K Jetronic (mechanical) fuel injection and 115 hp (still another anti-Golf!), since the basic version, fundamentally still quite rudimentary, could not compete with the GTI. Its neighbor was the new RS, a turbo racing car, echoing the XR3 body but with rear-wheel drive.

#### Electronics Everywhere

The advent of inexpensive, reliable, compact microprocessors, has revolutionized automotive technology. These little chips have become a universal solution for all problems: they provide ideal control for ignition, injection systems, and transmissions, and they feed pre-digested and selected information to the driver.

In Frankfurt, the trend toward their generalized use was confirmed. Alfa Romeo showed a very sophisticated injection cut-off system; Toyota introduced its Navicom, a digital instrument panel which is so ingenious that an artificial voice assists the driver; and VW followed suit on its Auto 2000 prototype.

As for Volvo, it is still perfecting its Volvo Computer Control Turbo (VCCT), which enhances the efficiency of the turbocompressor by reading and controlling numerous parameters, such as consumption, pollutant emission, performance, and so on.

## Return of the Turbine

Without VCCT, but with a turbine, Volvo presented the world's fastest station wagon, the turbine-powered 245, which exceeds 200 km/h and accelerates from 0-100 km in nine seconds! The most interesting item at this stand however, was a Series 2 equipped with a gas turbine under the hood. Following the setback with turbines of the most committed manufacturer in this field, Chrysler, it was thought that gas turbine projects had been abandoned. Together with United Turbine and Professor Kronogard, Volvo (assisted by the Swedish government) is investing heavily in a new turbine (with rotating exchanger) which should be operational in 1982-1983. Even spinning at 70,000 rpm and using advanced technology (ceramics) to withstand high speeds and temperatures, the modern turbine appears to be reaching an interesting stage of development from the standpoint of consumption, size, and weight.

This would also appear to be the opinion of Mercedes, which presented its gas turbine as a competitive alternative to the turbo-diesel V6 and to the gasoline V8 with cylinder cut-off (a system similar to that of Eaton-Cadillac). Well hidden in the Garrett stand, another gas turbine developed for NASA and Ford seemed to confirm the new direction of research, this time in terms of weight (Mercedes and Volvo) and size. In the opinion of its designers, the industrial technology for turbocompressors with hot turbines has made great progress in terms of methods, reliability, and price. As a result, gas turbines have regained some interest, especially since the weak point in the system, the exchanger, has also changed a great deal, both in terms of process (Volvo) and fabrication.

In summary, the highly technologic Frankfurt Salon really was the Salon of the future and of hope.

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CSO: 3102/8

## TRANSPORTATION

### HYBRID ENGINE EXHIBITED AT FRANKFURT AUTO SHOW

Bonn DIE WELT in German 21 Sep 81 p 16

[Article by H.-P. Rosellen: "Revolutionary Engine?--The Stelzer System Consists of Just 8 Parts"]

[Text] H.-P. Rosellen, Frankfurt--Far removed from the established exhibitors stands a man at his booth in a corner of hall 6 at the Frankfurt Auto Show--a man who would revolutionize engine making, Frank Stelzer.

The 47-year-old from North Frankfurt lists on his registration card the profession of "inventor and designer." At his stand is a trailer chassis supporting a crude-looking iron block; it is what is known as a free-piston engine. From the block, which is about as big as two standard German postal packing cartons, a shaft projects to the left and right. Inside, the shaft is thinner and houses combustion chambers. Combustion impulses confirming to the two-stroke principle are generated by opposed spark plugs located in the center of the block. The impulses shove the shaft back and forth. "The construction is absolutely simple," explains Stelzer, "only the shaft moves."

The entire engine consists of only 8 parts. Stelzer: "In an emergency, even a housewife can put it together." The machine produces almost no vibration, and its fuel consumption is about 30 percent lower than that of conventional engines. Since no counter force is present, the shaft oscillates back and forth almost without resistance. Accordingly, less wear is experienced than, for example, in the case of an Otto engine piston. Since the shaft is hollow the device could operate as a pump.

This would be an ideal hybrid drive for automobiles. In this application, windings around the shaft would generate current which, in turn, would drive electric motors in the 4 wheels of the auto. With a total displacement of 500 cc, the exhibition piece produces 200 PS which would more than compensate for the energy loss along the transmission path to the wheels.

Stelzer has been working on his idea for 20 years. The lean man, who freely admits to being DM 2 million in debt, has tried again and again over the years to find parties in the auto industry with an interest in his patented system; however, in vain. An industrial engineer told him quite openly that it would be better for the auto makers to wait until his patent expires and then build the engine without paying a licensing fee. "Just in June I paid DM 95,000 to extend the patent protection," said the inventor bitterly.

Some important improvements on the new engine may still be needed before it is mature enough for production. For example, if one side of the ignition system fails, the shaft could shoot out with catastrophic consequences. But in any case the idea is disarmingly simple. Valves, connecting rods, cam shafts--all of the many hard-to-build parts are entirely absent from the Stelzer engine.

9160

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## TRANSPORTATION

### RENAULT 9 FAMILY EXHIBITED AT FRANKFURT AUTO SHOW

#### General Description

Paris L'ARGUS DE L'AUTOMOBILE in French 17 Sep 81

[Article: "The Renault 9 Line: A Large Family"]

[Excerpts] A very modern car, the Renault 9 comes on the automobile market with many points in its favor. First of all, its design is traditional, with a three-compartment body. Elegant and discreet, to the extent that it does not especially attract attention among the sea of other cars, it should draw the broadest approval and not generate particular criticism. In addition, its size is reasonable (4.06 m long) while providing excellent room for five persons, with the rear passengers benefiting from the ingenious design of the front seats. The interior is very completely outfitted, and the presentation and finishing are very correct.

Mechanically, the Renault 9 remains faithful to front-wheel drive, with a transversal engine equipped with a gearbox located as an extension of the engine rather than above it, as in the Renault 14 which has an engine designed by Peugeot-Renault-Douvrin. The independent four-wheel suspension has a front-end with negative offset, and a rear-end with transversal torsion bars of a new design, which eliminates the previous design's wheelbase difference between the right and left wheels. The front wheels have disk brakes, and the rear, drum. So much for the general presentation; let us now look at some details.

The Renault 9 line consists of 11 versions, nine of which will be sold in France. The line is created by combinations of three engines, three gearboxes, and six levels of equipment.

The three four-cylinder engines are offered in two sizes: 1108 and 1397 cc. The 1108 cc engine develops 47.5 DIN hp at 5250 rpm, with a torque of 8.15 mkg at 2500 rpm; it is considered a 5 hp for fiscal purposes. It forms the C version of the Renault 9 line. The second engine, the 1397 cc, puts out 60 DIN hp at 5250 rpm, with a torque of 10.4 mkg at 3000 rpm. It is considered a 7 hp for fiscal purposes, and forms the L version. The third version uses the same engine, with its power increased to 72 DIN hp at 5750 rpm, and a torque of 10.8 mkg at 3500 rpm. It is also a 7 hp and forms the S version. It is likely that a fourth version will be introduced around next spring, equipped with the same engine; this time, it will develop 68 DIN hp at 5250 rpm and a torque of 10.8 mkg at 3000 rpm, and will have a three-speed automatic transmission. It will be called the 9 Automatic.

To the letters C, L, or S, which define the engine, will be added one or two other letters (T, GT, or TE) which refer to the level of equipment. This will create a line of nine models (for France), which will be offered at very competitive prices:

| Version | Price    |
|---------|----------|
| C       | 35,900 F |
| TC      | 37,700 F |
| GTC     | 39,900 F |
| TL      | 38,800 F |
| GTL     | 41,200 F |
| TLE     | 43,800 F |
| GTS     | 44,800 F |
| TSE     | 46,500 F |

The price of the 9 Automatic has not yet been established, but it could fall in the range of the TSE.

The basic C version is already well equipped: windshield wiper with two speeds and intermittent sweep, wear indicator for brake pads, trunk light, central console, and so on. The TC, TL, and TS versions will additionally have a locked gas cap, arm rests on the right-hand front and rear doors, a storage compartment on the left-hand front door, a rear window heater, and so on. Also available at this level, are single-pedestal seats with longitudinal adjustment only (only the driver's seat is adjustable in the C version).

The GTC and GTL versions have single-pedestal seats with complete functions, a dashboard dimmer, trip odometer, oil level indicator, iodine headlights, back-up lights, rear foglights, and so on. The GTS version is recognized by its five-speed box, its aluminum wheels, and its rear spoiler. It also has a tachometer, oil pressure gauge, sport steering wheel, two horns, hot air duct to the rear seats, and so on.

And finally, the top versions TCE, TLE, and TSE, have a rear view mirror adjustable from inside the car, headlight aiming control, advanced finishing, and such options as electric windows, electromagnetic door locks, air conditioning, and so on.

#### What Are Single-Pedestal Seats?

These very comfortable seats belong to a new generation. They allow the front seat passenger to change position during a trip, and the driver to adjust the seat for best support under the knees: in addition to the usual longitudinal displacement and seat-back tilt, they allow the entire seat to pivot. The rear passengers thus can stretch their legs on each side of these centrally supported seats.

#### Three Economy Factors

We have seen that at the suggested prices, the Renault 9 is an economical car to buy compared to its competition.

It is also economical in terms of fuel. The 5 hp C series consumes only 5.4 l per 100 km at 90 km/h, 7.4 l at 120 km/h, and 7.1 l in town. For the 7 hp L series, consumption becomes 5.7 l, 7.5 l, and 7.4 l. With the S series, consumption drops to 5.4 l per 100 km at 90 km/h, 7.2 l at 120 km/h, and 8.8 l per 100 km in town.

The same is true for maintenance: engine oil is drained only every 7500 km, and the gearbox oil is changed every 65,000 km. The engine head no longer has to be tightened after delivery nor later, brake pads are changed without removing the calipers, front fenders are bolted on and thus easily removed, and so on.

### Technical Details

Paris L'ARGUS DE L'AUTOMOBILE in French 17 Sep 81 pp 6-7

[Article: "First True World Car, Light, Economical, Well Designed"]

[Text] Love at first sight is also possible in technology: we cannot deny that the R 9 seduced us as soon as we first examined it, and that our European colleagues have also fallen under its spell.

In short, Renault has bet everything on design in order for this world car to be a Renault, without the usual shortcomings of Renaults. No more of the rolling in the turns, so dear to the R 5, and no more vague braking and stick shifting: the engineers have finally had the means to put an end to the black marks awarded by customers.

First car since the second oil crisis, the R 9 truly meets the specifications of the 1990's. The computer-assisted design has made it possible to reduce weight and therefore consumption. A transversal engine (finally!) leaves a larger passenger compartment for a competitive total length. The inside volume is remarkably well organized, with cleverly designed front seats allowing rear seat passengers the room to stretch their legs.

The engine is of matching quality: with no reservations, the old Cleon cast iron block of the R 5, with its lateral camshaft, has been reused because it is a miracle of economy. In conjunction with new heads, four or five-speed manual transmissions, or three-speed automatic ones, it provides a minimum of dash at 1108 cc and honorable performance at 1397 cc, but low consumption in either case.

The most interesting part is that the R 9 was designed for maximum robotized fabrication: not only have robots been entrusted with all cutting, stamping, welding, and body painting, but for the first time portions of the assembly will be performed without human intervention. The modernization of the Douai plant, where six automatic units for shell fabrication have been placed in service, exceeds the most recent Japanese plants: we are glad that Renault could match its competitors at the best price levels in the world, and fight them without having to resort to the anti-Japanese protectionist guerilla warfare that it recently launched in this country.

With original and efficient suspensions, and with great concern to facilitate repairs, the R 9 is consistent independently of the observer's standpoint. What are its weaknesses, then? From a strictly French viewpoint, we could reproach it its banal styling. But on second thought, this defect could well be an advantage in terms of world exposure, since only a body that is a common denominator for various tastes can assure its success. Moreover, its apparent platitude is nonetheless stamped with a fine balance, maybe even a classicism, which can be adapted to any market with a few minor changes.

In summary, Renault has invested with a free hand to achieve an excellent product and manufacture it at the lowest cost; let us hope that the world will welcome it warmly, and that sales and manufacturing forecasts will be fulfilled. The problem is that if a model as successful as the R 9 (which we sincerely believe it is) will seriously dent the competition, it will also weaken some of Renault's positions: how can we avoid thinking of the two-compartment cars of the R 9 and R 14 types, and of the two ends of the slot, the R 5 and the R 18.

#### Computers to the Rescue

It might be easier to understand the amounts of money invested in the study of a new model if we knew that the R 9 employed 500 people for 14,500,000 hours of studies and tests. More than 100 prototypes or "mules" covered 2,200,000 km in endurance tests, and the engines (even though their blocks are well known and produced in the millions) were run for 13,000 hours on the bench.

However, the proudest achievement of the research department is CAO (computer-aided design). Each structural element is calculated by the computer and shown on a screen by a series of lines which mean nothing to the uninitiated. But for engineers, all this work is essential: they can then visualize on their consoles the deformations of the whole. All of this is virtual, and graphically represents an impressive number of calculations. All the large manufacturers use such procedures, which make it possible to simulate the deformations and vibrations of parts which will never be built! This saves a lot of time, and a lot of money as well, since the first prototypes to be built will already have been tested by the computer's brain.

#### Making it Lighter...

The major advantage is that it permits the readoption of various design habits, and serious lightening of structures for equal strength. The second positive point of the method is that it tracks noises to their source by eliminating vibrations which generate noises, or by controlling them so that they will not amplify each other.

CAO has made it possible to define an R 9 which is basically very quiet, but especially very light (805 kg for the basic model!), particularly since there has been no hesitation to use high performance materials. Compared to their conventional counterparts, the weight savings have been 35 percent for the forward bumper, 12 percent on the front end (solely because of design!), 10 percent on the headlights (thanks to plastic shells), 12 percent on engine accessories, 20 percent on the differential, 10 percent on the idler gears, 25 percent on the wheels, 10 percent on the exhaust, and 15 percent on sound insulation.

Even more visible are the gains obtained on the rear seats (33 percent): they are now built of foam blocks (a technique adopted by Peugeot for the past 15 years!). As to the side and rear windows, they are now only 3.15 mm thick instead of 4 mm, lightening the upper glass portion by 20 percent, with all that this implies for road handling.

### ...Streamlined, and Safe

The three-compartment (or "three-volumes" cars, with an engine compartment, a passenger section, and a trunk), are known to be slightly less streamlined than the two-compartment or "two-volumes" cars of the type R 16, R 20, R 30, and R 14. The most recent research has shown that the shape and airtightness of the front, the absence of gutters (at least on the windshield risers), and the proper design of ancillary flows (engine cooling, air conditioning, ventilation) are nearly as important as the overall shape of the car. The basic version of the R 9 has a maximum cross-section of 1.848 square meters and a very honorable Cx of 0.385. The GTS and TSE versions, thanks to a rear spoiler, reduce the Cx to 0.37; this is quite remarkable since the recent European average has been about 0.40 (it had been 0.42 earlier).

Passive safety remains the same, even if it is no longer fashionable nor a sales point: the body is practically indestructible, with the front and rear parts absorbing energy when crushed as a result of deformable points having been inserted in the cross beams. The usual arsenal of retractable steering column, soft-edged interior decoration, 60 mm-wide belts (compared to the competition's 50 mm), is complemented by two innovations: front seats of a new design, and flexible bumpers with shock absorbers.

### Important Innovations

The usual construction of steel-blade bumpers and laminated rigid bumpers, has been supplemented by an advanced approach consisting of:

- A flexible polypropylene bumper with rubber attachments;
- Polyethylene energy absorbers;
- A multi-functional transversal beam connecting the side rails and supporting the absorbers.

The advantages of this construction are obvious: small shocks momentarily deform the bumper, which then resumes its shape. Heavier shocks are borne by the absorber, which can then be replaced to bring the whole assembly back to its initial condition.

Large shocks involve the entire structure, but Renault must be credited with an effort toward standardization by locating the front and rear bumpers at the same level.

And while the front seats fulfill a new concept in safety, they also offer a considerable advantage to the rear seat passengers by allowing them to stretch their legs on each side of the two slides, which are only 15 cm apart.

Why didn't anyone think of it before, we ask, thinking of the cleverness of the system. The engineers' answer is that this solution is very costly in terms of studies, and because it involves an entirely new design of the shell! We only need to imagine the stress placed on the metal when a 110-120 kg driver sits down and his movements are transmitted to a piece of sheet metal (thick enough, of course) through such a narrow area.

#### A New-Look Shell

Even if the ability and strength of robot welders is infinite, they nevertheless resemble humans: they work better if their task is simple. That is why the shell was designed with their capabilities in mind. For instance, the floor consists of two frame members, one in front and one in back, overlapping a central floor. The other elements are gathered around this base, where they are welded with great precision.

Light and rigid, this shell must furthermore be reliable over a long time period, and therefore protected from corrosion. Here again, nothing was stinted: depending on the degree of exposure to the elements, Renault used sheets pre-protected with a zinc layer, sheets which received two coats of zinc chromate paint or which were sprayed with zinc, and so on. The remainder, phosphating (with zinc, which is better than iron), passivation, cataphoretic anticorrosion coats, are conventional and as good as the competition's best. The protection is completed with a PVC undercoating on the body, and with deposits or injections of caulking or waxy tars wherever there exists a risk of water retention in an end piece or hollow area.

#### Long Live Comfort!

These additions have a soundproofing effect, reinforcing that of the other elements installed on the body for that purpose. Tar paper cemented to the floor (which is conventional) reduces the propagation of vibrations, but special attention was given to the sound insulation of the passenger compartment by building a one-piece wall parallel to the metal wall which separates the engine from the passengers. Numerous silent blocks, as well as the lining cemented to the roof, contribute to the passengers' protection from noise. Rolling noises are well filtered, and aerodynamic ones are slight; as a result, the ventilation also had to be silent. This has been achieved rather successfully, as has the heating, which uses the principle of air mixing so as to improve progressiveness and the stability of adjustments. For once, the rear seats have not been overlooked (in top of the line versions, however), together with the existence of a pulsed fresh air supply. We will have to wait for winter to find out if this installation is effective, but we are betting that the "world" goals of the R 9 have caused it to be tested under all climates.

To close the comfort chapter, we mention again the single-pedestal front seats, whose curved slides make it possible to vary the seating angle. An additional advantage is that when the passenger wants to rest, the seat cushion tilts at the same time as the back: the thighs are supported, and this position, comparable to the one in relaxation armchairs, maintains the effectiveness of the safety belt, which is not the case when the seat back alone is tilted (the body can slip from under the belt).

## Road Holding

In order to reconcile road holding, low cost, small size, and easy maintenance, engineers have been led to adopt solutions whose principles were well known, but which required very sophisticated design.

The front end is a "false" MacPherson design, so named because its triangle is formed below and is therefore much more solid. Associated with a negative ground offset (from 11 to 6 mm), a slight offset at the spindle (about 50 mm), a small caster angle (2 degrees 30 minutes), and an axial suspension stop (new, stamped out), the R 9's MacPherson design provides a high quality control linkage: the most important part however, is that all the elements, including the strong roll-bar, are articulated on a "false chassis" which also carries the engine; the latter is itself bolted to the front side rails, with various tie rods (tubular) that attach it to the shell, further enhancing the rigidity of the whole. It goes without saying that the idea is sophisticated, but the performance and reliability results are surprisingly good. Moreover, SNR (New Ballbearing Company), a Renault subsidiary, has created for the R 9 new insert bearings with two rows of balls (patented), and designed the famous axial stop which reduces the steering effort, as well as new bearings with two rows of conical rollers for the rear. At this location, the drum is attached to the axle with a collar and seal.

## Less Roll

But the most original aspect of the rear suspension is unquestionably the two trailing half-arms associated with the torsion bars. This offers many structural advantages, but notably the fact that the two torsion half-bars are located exactly on the same axis and connected in a very ingenious manner. Here again, a great deal of thought had to be invested to conceive a rear-end that is as simple to manufacture, and especially one that performs as well for steering and tracking self-correction, and that reduces drifting and rolling thanks to an anti-banking bar.

But the driver could not care less about technology: he wants to drive a car that is comfortable, easy to handle, reliable, eye-catching. A road test of various R 9's (shod with Klebers, which are well matched to the R 9 suspension), under a full fledged downpour, brought out the car's most interesting points: easy, accurate steering, power, and especially, limitation of pitching and rolling. In our convoy, the R 9's performed better than a 2-liter Fuego and the 14 TS's running at the end of the pack! The quality of the suspension has two ancillary effects: braking, provided by Bendix Series 4 disks and calipers in front, and drums in the rear, is remarkable; and the great road holding capabilities of the R 9 make it seem underpowered. This is a characteristic of good cars (such as the basic Golf or the Opel Kadett), which we hope will eventually have the more powerful versions which they deserve.

## Two Engine Sizes

For the time being, the R 9 is available in the 5 hp (fiscal) version with the 1108 cc four-cylinder, for the C, TC, GTC, and TCE models, with 47.5 hp at 5250 rpm and 8.15 mkg at 2500 rpm. The TL, GTL, and TLE models have the four-cylinder 1397 cc (7 fiscal hp) engine, with 60 hp at 5250 rpm and a torque of 10.4 mkg at

3000 rpm. Only the top of the line TS, GTS, and TSE have two carburetors: the 1397 cc engine then develops 72 hp at 5750 rpm and 10.8 mkg at 3500 rpm, with respective top speeds of 138, 150, and 160 km/h, but also with remarkably low consumptions. This three-compartment car, with a length of 4.06 m, a width of 1.634 m, and with four seats, consumes only 5.4, 7.4, and 7.1 liters for the 1108 cc; 5.7, 7.5, and 7.4 liters for the single-carburetor 1357 cc with four speeds; 5.4, 7.3, and 7.4 liters with the same engine and the five-speed box; while the two-volume with the 1397 cc engine posts 5.4, 7.2, and 8.8 liters at 90 km/h, 120 km/h, and city driving, respectively.

A single version of the two-carburetor, 68 hp (at 5250 rpm), 1397 cc engine has been designed to make better use of the five-speed automatic transmission. Its performance and consumption are not yet known, but they will be better than that of the GTS because of the heavier transmission and its slippage.

#### All-Purpose Block

The engine block is the cast iron Cleon of the R 5 and R 18. The consensus is that it surpasses in rigidity and losses the most recent injected aluminum creations. It might be a little heavier, but it is so rigid and reliable! The heads, however, are entirely new: first, because the transversal position is new for this block, and also because the company foundry and aerodynamics laboratory studies have advanced Renault's knowledge. Thanks to well controlled turbulence and better cooling of critical areas (sparkplugs, exhaust valves), the performance of new heads manufactured by the subsidiary Fonderies de Poitou near Chatellerault, is very good. Following the new trend toward intake at low flow rates, the camshaft is significantly shallower. The 1.4-liter engines have built-in electronic ignition in order to retain high performance and low consumption over long term usage; here then is an engine block designed many years ago, distributed for some ten to twenty years, which is easy to manufacture, and whose Cx of 0.37 and weight (between 805 and 845 kg in operating condition) facilitate its use.

#### A Well-Born Cradle

One of the last original features of this car--of which there is no shortage--is the presence of a "false chassis" or cradle in front. This solid parallelogram supports not only the engine, but the transmission, front suspension, and radiator as well. This assembly is so coherent that the front end can be aligned even before the cradle is installed on the car! It lends rigidity to the front side rails, but also fulfills many other additional functions: eliminates vibrations thanks to a very sophisticated silent block at the rear of the engine; improves control accuracy thanks to an anti-torque tie-rod which limits engine deflection; and especially, makes it possible for an assembly robot to install the engine without human intervention. The engine-transmission assembly is placed on a hoist which raises it and introduces it into the shell from below: only four bolts have to be tightened when the radiator butts against its upper location spring. This also should give an idea of the post-sale advantages of the car.

## Easy to Repair

Renault is now much more concerned with post-sales work. It has finally followed the example of our German neighbors, where this requirement is much more prevalent. For instance, the clutch can be changed in a very short time, without removing either the engine or the transmission; other ingenious touches can be found here and there, but the general design of the body and mechanical components is satisfactory overall. And while the quality of finishing cannot be judged from prototypes, a real effort can be noted with the soundproofing of door jambs, electromagnetic locks, and water-spray windshield wipers (a patent bought from Ford) which are widespread in the United States, and which show the "world" orientation of the car.

All new, all beautiful. We shall see whether this R 9 keeps its promise in use, but we must admit that this car is full of good ideas at all levels. Renault has attacked the technical problems in the best possible way: the rest is up to the dealers, and they too, know their business.

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## TRANSPORTATION

### AUTO 2000 MAKES DEBUT AT FRANKFURT AUTO SHOW

Paris LE MATIN in French 18 Sep 81 p 16

[Article by special correspondent Philippe Hazan]

[Text] Engineers of the Volkswagen company have unveiled a technical achievement with the introduction, at the Frankfurt Auto Show, of an automobile still in the prototype stage that consumes 3.3 liters of Diesel fuel per 100 km: The Auto 2000. This is a performance figure never before attained by a Diesel engine, and marks the advance of the Germans in the field of research.

Of course, the Renault 9 stole the show from all the other automobile makers who exhibited at the Frankfurt Show (which will close its doors on 27 September). Of course, Opel's new front-wheel driven Ascona did not go unnoticed, and its competition against the Renault 9 for the title of Automobile of the Year will be strong.

However, it was another automobile that riveted the attention of many technical experts: The Volkswagen Auto 2000. A prototype whose design is based on the Golf, that consumes 3.3 liters of Diesel fuel per 100 km, and that is powered by an innovative 3-cylinder, Diesel turbocharged engine.

A closer examination of this model yields one surprise after another. To begin with, the supercharging can be effected either by means of a turbine-driven compressor or by the Comprex system that Ferrari used without success, at the beginning of the season, on his Formula 1 single-seaters. Of course, VW's is not exactly the same thing, but the principle is identical. Here, the Bosch ABS anti-locking brake system is mounted in a small car for the first time.

The instrument panel is a digital display unit with "voiced" warning signals to the driver in synthetic language! The "stop and go" system restarts the engine, which is automatically shut off during stops for traffic signals or traffic jams. Actually, although this VW 2000 is still in the prototype stage, it should not be considered a gadget factory.

The German technicians consider the required time span between invention and mass production to be very brief. In achieving a figure never before attained

of 3.30 liters per 100 kilometers at 90 km/hr (that is, less than 2.90 centimes per passenger kilometer!), Volkswagen has now overtaken the French engineers in the war of energy economies.

The latter are known to be working on the "3 liters of gas per 100 km in 1990" project that was handed to them in September 1990 [as published] by the minister of transport, based specifically on the Vera (Peugeot-Talbot) and the Eve (Renault 4). It is evidently easier to obtain record figures on a Diesel engine than on its gasoline counterpart, and there can be no doubt that the design and development departments of the big French automobile manufacturers intend to be exactly punctual at their 1990 rendezvous... .

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## TRANSPORTATION

### VOLKSWAGEN, MERCEDES INTRODUCE NEW MODELS AT FRANKFURT

Paris L'ARGUS DE L'AUTOMOBILE in French 17 Sep 81 p 1

[Text] Among the many new models exhibited at the Frankfurt Auto Show, Volkswagen showed its 1982 Polo and Derby models and its 1983 vintage Santana. Mercedes unveiled its line of SEC Coupes.

The new break-bodied Polo, 3.65 m long (45 cm longer than last year's model) and 1.58 m wide (20 mm wider), offers more passenger space and a trunk whose maximum volume, rear seat folded down, is 1,000 liters. Featuring again the tested mechanical elements of last year's model, the Polo is front-wheel driven by a transversally mounted 1,043-cm<sup>3</sup> (40-hp), a 1,093-cm<sup>3</sup> (50-hp), a 1,272-cm<sup>3</sup> (60-hp), or a 1,093-cm<sup>3</sup> Formula E (50-hp) engine. Despite its station-wagon style body (close to that of the Metro), its Cx [aerodynamic coefficient] is 0.39 and its fuel consumption is remarkably low in its Formula E version: 4.8, 6.7 and 7.3 liters at 90 km/hr, 120 km/hr and in town respectively. It will be marketed beginning about mid-November.

The Derby is a small 3-volume model, 3.97 m long and 1.57 m wide, powered by the same engines as the Polo. The new body design and the raised trunk (540 liters, or 25 more than last year's model) give it increased passenger space and improved aerodynamics: Its Cx is 0.40 versus last year's 0.44. It will be deliverable in France in three finishes--C, CL and GL--in the spring of 1982.

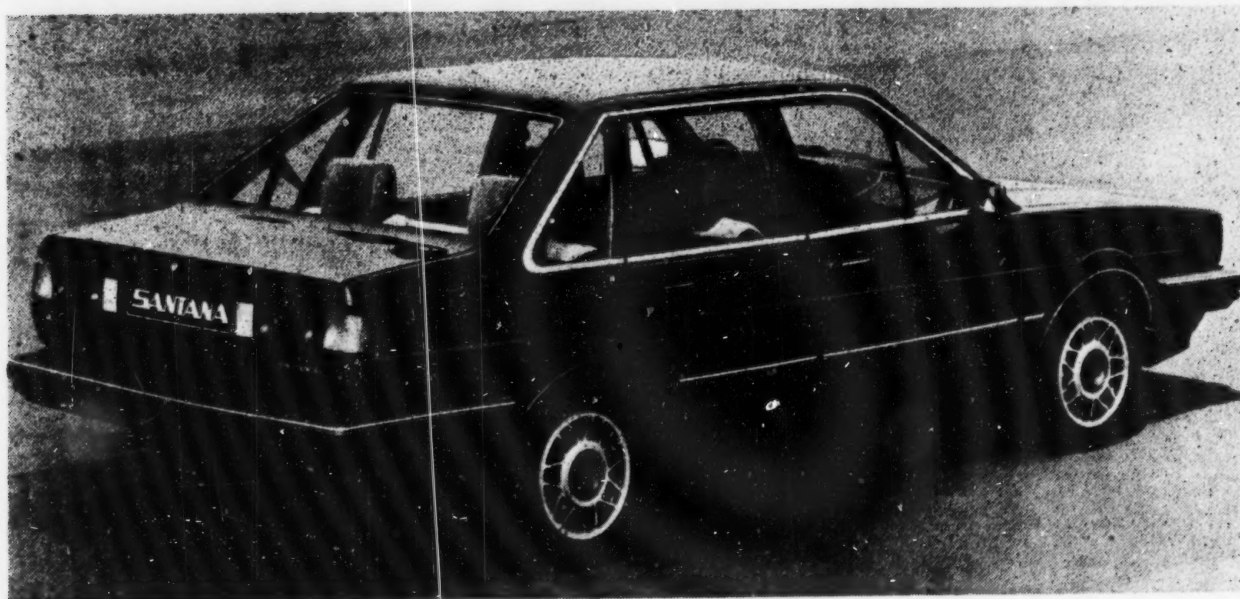
As for the Santana, it will be October 1982 before this top-of-the-line limousine is seen in the streets of the Hexagon. It is 4.54 m long (same as the 505 and 10 cm longer than the Passat), and is powered by a 1,588-cm<sup>3</sup>, 75- or 85-hp, or a 1,921-cm<sup>3</sup>, 5-cylinder, 115-hp, or a 1,588-cm<sup>3</sup>, 54-hp Diesel engine.

The new Mercedes 380 SEC and 500 SEC Coupes replace the 380 and 500 SLC's, production of which stopped in August. Performance characteristics are again remarkable: Peak speeds of 210 and 225 km/hr respectively, while, thanks to a record-breaking Cx of 0.34 and a number of other improvements, fuel consumptions have been lowered by from 20 to 24 percent. Fuel consumption figures of 10.8 liters (380 SEC) and 11.4 liters (500 SEC) at 120 km/hr with elegantly styled

[Right]: Volkswagen's  
1982 Polo.



[Left]: Volkswagen's  
1982 Derby.



Above: Volkswagen's 1982 Santana.



Mercedes' SEC Coupe

Coupes capable of reaching 100 km/hr in 9.8 and 8.1 seconds respectively is a noteworthy achievement, but the gains are even more substantial in town: 13.9 liters (380 SEC) versus 19 liters (380 SLC) and 15.2 liters (500 SEC) versus 20.7 liters (500 SLC)--a striking accomplishment that illustrates Daimler Benz AC's mastery of the technology.

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